Battling Bisons' Mysterious MCF Disease

JACK DYKINGA (K5680-1)

A disease that has buffaloed scientists, veterinarians, and bison ranchers is yielding some of its secrets. That's because of innovative research by ARS scientists and their Washington State University colleagues. They've developed new tests for detecting and correctly identifying the disease, known as malignant catarrhal fever, or MCF. These tests are the work of veterinary microbiologist Hong Li of the ARS Animal Disease Research Unit and veterinary virologist Tim B. Crawford of Washington State University, both in Pullman, Washington.

"MCF's history in veterinary medicine can be traced back to the late 1700s," Li says. "The disease affects many domestic and wild ruminants—animals that have multichambered stomachs—such as cattle, bison, and deer. It is caused by a group of herpesviruses with very complex life cycles. Several ruminants serve as carriers of MCF viruses. In the United States, the most prominent carrier is the domestic sheep."

Sheep Don't Succumb

"Sheep MCF virus, or ovine herpesvirus 2, is the cause of most MCF cases in the United States," says Li. "Sheep carry MCF virus, but apparently are not susceptible to the disease. It is often fatal to some other animals but is harmless to humans.

"MCF occurs sporadically," adds Li. "There's much about it that we still don't understand. Though both cattle and bison can die from the disease, bison seem more susceptible. In fact, MCF is one of the leading infectious diseases of bison, so it's a top research priority of the American bison industry."

Some 300,000 bison are currently being raised in the United States for their unique, low-fat meat. That's according to Donal O'Toole, who collaborates with Li and Crawford. O'Toole is a veterinary pathologist at the University of Wyoming, Laramie.

Sheep inadvertently spread the virus, mainly from their nasal secretions. Bison or other animals sharing the same range, pasture, feed or, perhaps, water, with the sheep may come into contact with the virus particles shed by the sheep. Notes O'Toole, "The virus doesn't live very long once it's shed."

An early and telltale sign of the disease is a severe runny nose and often a custardlike discharge that eventually encrusts the afflicted animal's muzzle. Other symptoms that follow may include mouth ulcers; cloudy, whitened eyes; swollen lymph nodes; bloody diarrhea; and a high fever—as much as 107˚F, as compared to a healthy bison's normal 101˚ to 102˚F.

Tests Identify Antibodies and Virus

Today there is no treatment or cure for MCF and no vaccine. Yet the tests that Li and Crawford developed may someday help prevent this disease.

One assay is a CI-ELISA, short for competitive inhibition enzyme-linked immunosorbent assay. This blood test is best used for screening healthy herds of MCF-susceptible animals—bison or cattle, for example. It determines whether any of the animals, even if they are not showing any signs of illness, are carrying an MCF virus.

Li points out, "Besides screening MCF-susceptible animals, the test is also very useful for screening carrier animals, such as sheep, for MCF virus." The team's CI-ELISA can detect even very small amounts of antibodies that the animal makes in response to the invading virus. Li explains that the CI-ELISA is the first test capable of detecting antibodies that are formed in response to MCF viruses. It is a significant improvement over earlier MCF blood tests.

PEGGY GREB (K9876-1)

Veterinary microbiologist Hong Li (left) and veterinary virologist Tim Crawford select sheep for an MCF transmission study.

Although the assay can indicate whether an animal has made antibodies to MCF, it can't distinguish among members of the MCF virus family. That's the job of tests that are based on what's called a polymerase chain reaction, or PCR.

"Researchers in Scotland," says Li, "developed a PCR for sheep MCF virus. We adapted that to develop other PCRs, including a quantitative one for MCF research. The quantitative PCR tells us not only which MCF virus is present, but also how much of it there is."

PCR tests are useful for identifying new MCF viruses. For example, Li's group was the first to identify a new MCF virus in domestic goats. What's more, they used PCR technology to discover another new MCF virus that causes the disease in white-tailed deer. Li did the deer work with veterinary pathologist Neil W. Dyer at North Dakota State University.

Having this array of PCRs may help reveal which viruses in the MCF family are deadly to which species of livestock or wildlife. That information could help livestock producers, wildlife specialists, and zoo managers.

Diagnostic Tests Prove Useful

Today these tests can be performed at regional veterinary diagnostic laboratories on behalf of researchers and veterinarians who send in specimens. For instance, the Washington Animal Disease Diagnostic Laboratory at Washington State University processes between 800 and 1,000 MCF diagnostic assays a year in addition to the thousands it runs for research purposes.

Zoos are also increasingly relying on the tests, reports Li. "They want to test their own animals as well as those they are interested in adding to their collections."

Li and Crawford have used the assays to determine a previously unknown interval during which newborn lambs are virus-free. "We found that most lambs are virus-free for about 6 to 8 weeks after birth," Li states. "So you can establish a virus-free flock if you take lambs from their infected mothers before that time is up."

For that work, they collaborated with ARS animal scientist Gary D. Snowder at the agency's U.S. Sheep Experiment Station, Dubois, Idaho. Li says several zoos in North America have begun using this regimen to produce MCF-free sheep.

In addition, the tests have been "very crucial to bison MCF research," asserts Li. Says colleague O'Toole, "The tests, for example, have shown that cattle are significantly less susceptible to ovine herpesvirus 2 than are buffalo."

A study by researchers in Pullman and Laramie revealed that at least 25 to 35 percent of all bison are infected with the MCF virus.

Li received a top regional award from ARS in 2000 for his pioneering research. In addition, he has served as special expert for the United Nations in establishing diagnostic assays for MCF in West Africa.

PEGGY GREB (K9875-1)

To test for antibodies to MCF virus, technicians Jan Keller (back) and Lori Fuller conduct a CI-ELISA.

Li and colleagues have reported their findings in the *Journal of Clinical Microbiology* and the *Journal of General Virology* as well as many veterinary science journals, including the *Journal of Veterinary Diagnostic Investigation.*

VMRD, Inc., of Pullman, Washington, sells the reagents for the MCF CI-ELISA.

More information on MCF is available at http://www.uwyo.edu/vetsci/mcf_q&a.htm.—By **Marcia Wood,** ARS.

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